

Product Description Document
New ICAO Space Weather Advisory Products
October 1, 2019

Part 1 – Mission Connection

1. Product Description:

The National Weather Service (NWS) Space Weather Prediction Center (SWPC), as part of its mission, creates and disseminates space weather alerts, watches, warnings, event summaries, and outlook discussion advisories. In November 2018, the International Civil Aviation Organization (ICAO) selected SWPC as one of the three global space weather centers (SWXC) to monitor and provide advisory information on space weather phenomena expected to affect high-frequency radio communications, communications via satellite, Global Navigation Satellite System (GNSS)-based navigation and surveillance systems, and/or pose a radiation risk to aircraft occupants. The SWXCs are required to disseminate advisory information regarding the extent, severity, and duration of the space weather phenomena and supply the advisory information to area aeronautical control centers, flight information centers, aerodrome meteorological offices, the other SWXCs, international operational meteorological information (OPMET) databanks, international Notices to Airmen (NOTAM) offices, and aeronautical fixed service Internet-based services.

The SWXCs are required to monitor and develop new products to issue advisory information for the following space weather phenomena:

- 1) high frequency (HF) radio communications;
- 2) communications via satellite;
- 3) GNSS-based navigation and surveillance; and,
- 4) radiation exposure at flight levels.

The space weather advisories will be disseminated in accordance with the provisions in ICAO Annex 3 *Meteorological Service for International Air Navigation* and ICAO Document 10100 *Manual on Space Weather Information in Support of International Air Navigation*. By 7 November 2019, the SWXCs are required to disseminate space weather advisory information in abbreviated plain language and, by 5 November 2020, the advisory information shall be disseminated in ICAO Meteorological Information Exchange Model (IWXXM) in eXtensible Markup Language (XML)/geography markup language (GML) data format in addition to the dissemination of this advisory information in abbreviated plain language.

2. Purpose/Intended Use:

According to ICAO Doc 10100, the information and services required for safe and efficient aircraft operations will be provided by three designated SWXCs. The working principle for the SWXCs is to provide space weather advisory information that users can employ for decision-making. Some advisories will allow time for a well-considered response plan and no change to an already planned flight. The other extreme will be at the last minute, or enroute, necessitating a recalculation of a preordained flight plan. In many ways, these advisories will be similar to conventional, more familiar products and services documented in Annex 3.

The intended use of the ICAO space weather advisories is to better prepare flight crews, operators, air navigation service providers, and civil aviation authority when developing flight plans, operational procedures for managing flights in areas impacted by space weather events, situational awareness, in the broader context of managing multiple (numerous) flights to ensure safe and efficient operations, and properly integrating space weather into the existing docket of aviation considerations as prescribed actions, center requirements, and other functional necessities need to be in place to address the deleterious impacts to aviation in the State's purview.

3. Audience/Users:

NWS, Federal Aviation Administration (FAA), international civil aviation authorities, domestic and international commercial airlines, and private companies.

4. Presentation Format:

Annex 3 introduced a requirement to issue space weather advisory information similar in structure to advisory messages issued for tropical cyclones and volcanic ash clouds. The SWXCs issue the space weather advisory that informs the user of:

- a) the type of impact;
- b) the expected onset, or that the event is already in progress;
- c) the duration of the event;
- d) a generalized description of the spatial extent affected for the next 24 hours; and
- e) a description of the severity of the impact in moderate (MOD) or severe (SEV) categories.

5. Feedback Method:

The NWS is accepting comments/feedback through October 1, 2019, on the provision of the [mandated] ICAO Space Weather advisory products. Comments may be provided via email to:

jennifer.meehan@noaa.gov and bruce.entwistle@noaa.gov

The content and format are established through ICAO's requirements process, with U.S. comments provided by the U.S. aeronautical meteorological authority for international

regulation, the Federal Aviation Administration. The NWS is constantly seeking to improve the products produced based on user feedback and will forward user feedback to the U.S. aeronautical meteorological authority. Customers may provide feedback through the National Space Weather Program at NWS headquarters.

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Opportunities for face-to-face responses will occasionally occur in the context of conferences, public outreach events, etc.

Part 2 – Technical Description

1. Format and Science Basis:

The World Meteorological Organization (WMO) message headers (TTAAii CCCC) for the text and IWXXM Advisories are given below, noting that the ACFJ Consortium will issue advisories from two locations.

Advisory Center	WMO headers	
	Text Advisory	IWXXM Advisory
ACFJ - Australia	FNXX01 YMMC	LNXX01 YMMC
ACFJ - France	FNXX01 LFPW	LNXX01 LFPW
PECASUS	FNXX01 EFKL	LNXX01 EFKL
USA	FNXX01 KWNP	LNXX01 KWNP

The template for space weather advisory information to be disseminated can be found in the ICAO Annex 3 as shown below:

Key: (M) = inclusion mandatory, part of every message
(C) = inclusion conditional, included whenever possible
Each element begins on a new line.

Element	Detailed Content	Template(s)	Examples
1 Identification of the type of message (M)	Type of message	SWX ADVISORY	SWX ADVISORY

2	Status indicator (C) ¹	Indicator of test or exercise	STATUS:	TEST or EXER	STATUS:	TEST EXER
3	Time of origin (M)	Year, month, day, and time in UTC	DTG:	nnnnnnnn/nnnnZ	DTG:	20161108/0100Z
4	Name of SWXC (M)	Name of SWXC	SWXC:	Nnnnnnnnnnn	SWXC:	DONLON ²
<i>Element</i>		<i>Detailed Content</i>	<i>Template(s)</i>		<i>Examples</i>	
5	Advisory number (M)	Year in full and unique message number	ADVISORY NR:	nnnn/[n][n][n]	ADVISORY NR:	2016/2
6	Number of advisory being replaced (C)	Number of the previously issued advisory being replaced	NR RPLC:	nnnn/[n][n][n]	NR RPLC:	2016/1
7	Space weather effect and intensity (M)	Effect and intensity of the space weather phenomena and/or altitude of space weather phenomena	SWX EFFECT:	HF COM MOD or SEV or SATCOM MOD or SEV or GNSS MOD or SEV or HF COM MOD or SEV AND GNSS MOD or SEV or RADIATION ³ MOD or SEV	SWX EFFECT:	HF COM MOD SATCOM SEV GNSS SEV HFCOM MOD AND GNSS MOD RADIATION MOD
8	Observed or expected space weather phenomena (M)	Day and time (in UTC) of observed phenomena (or forecast if phenomena have yet to occur); Horizontal extent ³ (latitude bands and longitude in degrees) and/or altitude of space weather phenomena	OBS SWX: or FCST SWX:	nn/nnnnZ DAYLIGHT SIDE or HNH and/or MNH and/or EQN and/or EQS and/or MSH and/or HSH Wnnn(nn) or Ennn(nn) - Wnnn(nn) or Ennn(nn) and/or ABV FLnnn or FLnnn - nnn or Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - [Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]] or NO SWX WX EXP	OBS SWX:	08/0100Z DAYLIGHT SIDE 08/0100Z HNH HSH E18000 - W18000 08/0100Z HNH HSH W18000 - W09000 ABV FL350
9	Forecast of the phenomena (+6 HR) (M)	Day and time (in UTC) (6 hours from the time given in Item 8, rounded to the next full hour); Forecast extent of the space weather phenomena for that fixed valid time	FCST SWX +6 HR:	nn/nnnnZ DAYLIGHT SIDE or HNH and/or MNH and/or EQN and/or EQS and/or MSH and/or HSH Wnnn(nn) or Ennn(nn) - Wnnn(nn) or Ennn(nn) and/or ABV FLnnn or FLnnn - nnn or Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - [Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]] or NO SWX WX EXP or NOT AVBL	FCST SWX +6 HR:	08/0700Z DAYLIGHT SIDE 08/0700Z HNH HSH E18000 - W18000 08/0700Z HNH HSH W18000 - W09000 ABV FL350
10	Forecast of the phenomena (+12 HR) (M)	Day and time (in UTC) (12 hours from the time given in Item 8, rounded to the next full hour); Forecast extent of the space weather phenomena for that fixed valid time	FCST SWX +12 HR:	nn/nnnnZ DAYLIGHT SIDE or HNH and/or MNH and/or EQN and/or EQS and/or MSH and/or HSH Wnnn(nn) or Ennn(nn) - Wnnn(nn) or Ennn(nn) and/or ABV FLnnn or FLnnn - nnn or Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - [Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]] or NO SWX WX EXP or NOT AVBL	FCST SWX +12 HR:	08/1300Z DAYLIGHT SIDE 08/1300Z HNH HSH E18000 - W18000 08/1300Z HNH HSH W18000 - W09000 ABV FL350
11	Forecast of the phenomena (+18 HR) (M)	Day and time (in UTC) (18 hours from the time given in Item 8, rounded to the next full hour); Forecast extent of the space weather phenomena for that	FCST SWX +18 HR:	nn/nnnnZ DAYLIGHT SIDE or HNH and/or MNH and/or EQN and/or EQS and/or MSH and/or HSH Wnnn(nn) or Ennn(nn) - Wnnn(nn) or Ennn(nn) and/or ABV FLnnn or FLnnn - nnn or Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] -	FCST SWX +18 HR:	08/1900Z DAYLIGHT SIDE 08/1900Z HNH HSH E18000 - W18000 08/1900Z HNH HSH W18000 - W09000 ABV FL350

		fixed valid time		Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - [Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]] or NO SWX WX EXP or NOT AVBL		
Element		Detailed Content	Template(s)		Examples	
12	Forecast of the phenomena (+24 HR) (M)	Day and time (in UTC) (24 hours from the time given in Item 8, rounded to the next full hour); Forecast extent of the space weather phenomena for that fixed valid time	FCST SWX +24 HR:	nn/nnnnZ DAYLIGHT SIDE or HNH and/or MNH and/or EQN and/or EQS and/or MSH and/or HSH Wnnn(nn) or Ennn(nn) - Wnnn(nn) or Ennn(nn) and/or ABV FLnnn or FLnnn - nnn or Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - [Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn] - Nnn[nn] or Snn[nn] Wnnn[nn] or Ennn[nn]] or NO SWX WX EXP or NOT AVBL	FCST SWX +24 HR:	09/0100Z DAYLIGHT SIDE 09/0100Z HNH HSH E18000 - W18000 09/0100Z HNH HSH W18000 - W09000 ABV FL350
13	Remarks (M)	Remarks, as necessary	RMK:	Free text up to 256 characters or NIL	RMK:	SWX EVENT HAS CEASED WWW.SPACEWEATHERPROVIDER.WEB NIL
14	Next advisory (M)	Year, month, day, and time in UTC	NXT ADVISORY:	nnnnnnnn/nnnnZ or NO FURTHER ADVISORIES or WILL BE ISSUED BY nnnnnnnn/nnnnZ	NXT ADVISORY:	20161108/0700Z NO FURTHER ADVISORIES

Where the following space weather effects are defined by their respective abbreviations: HF communications (HF COM); communications via satellite (SATCOM); GNSS-based navigation and surveillance degradation (GNSS); and, radiation at flight levels (increased exposure) (RADIATION). Also, the intensities are abbreviated to indicate moderate (MOD) or severe (SEV).

Notes—

1. Used only when the message issued to indicate that a test or an exercise is taking place. When the word TEST or the abbreviation EXER is included, the message may contain information that should not be used operationally or will otherwise end immediately after the word TEST.
2. DONLAN is a fictitious location.
3. One or more latitude ranges should be included in the space weather advisory information for GNSS and RADIATION.

Example: Space weather advisory message for GNSS and HFCOM effects

SWX ADVISORY

DTG: 20161108/0100Z

SWXC: DONLON*

ADVISORY NR: 2016/2

NR RPLC: 2016/1
SWX EFFECT: HFCOM MOD AND GNSS MOD
OBS SWX: 08/0100Z HNH HSH E18000 - W18000
FCST SWX +6 HR: 08/0700Z HNH HSH E18000 - W18000
FCST SWX +12 HR: 08/1300Z HNH HSH E18000 - W18000
FCST SWX +18 HR: 08/1900Z HNH HSH E18000 - W18000
FCST SWX +24 HR 09/0100Z NO SWX EXP
RMK: LOW LVL GEOMAGNETIC STORMING CAUSING INCREASED
AURORAL ACT AND SUBSEQUENT MOD DEGRADATION OF GNSS
AND HF COM AVBL IN THE AURORAL ZONE. THIS STORMING
EXP TO SUBSIDE IN THE FCST PERIOD. SEE
WWW.SPACEWEATHERPROVIDER.WEB
NXT ADVISORY: NO FURTHER ADVISORIES

*Fictitious location

Example: Space weather advisory message for RADIATION effects

SWX ADVISORY

DTG: 20161108/0100Z
SWXC: DONLON*

ADVISORY NR: 2016/2
NR RPLC: 2016/1
SWX EFFECT: RADIATION MOD
OBS SWX: 08/0100Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX +6 HR: 08/0700Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX +12 HR: 08/1300Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX +18 HR: 08/1900Z HNH HSH E18000 - W18000 ABV FL350
FCST SWX +24 HR 09/0100Z NO SWX EXP
RMK: RADIATION LVL EXCEEDED 100 PCT OF BACKGROUND LVL AT
FL350 AND ABV. THE CURRENT EVENT HAS PEAKED AND LVL
SLW RTN TO BACKGROUND LVL. SEE
WWW.SPACEWEATHERPROVIDER.WEB
NXT ADVISORY: NO FURTHER ADVISORIES

*Fictitious location

Example: Space weather advisory message for HF COM effects

SWX ADVISORY

DTG: 20161108/0100Z
SWXC: DONLON*

ADVISORY NR: 2016/1
SWX EFFECT: HF COM SEV
OBS SWX: 08/0100Z DAYLIGHT SIDE

FCST SWX +6 HR: 08/0700Z DAYLIGHT SIDE
FCST SWX +12 HR: 08/1300Z DAYLIGHT SIDE
FCST SWX +18 HR: 08/1900Z DAYLIGHT SIDE
FCST SWX +24 HR 09/0100Z NO SWX EXP
RMK: PERIODIC HF COM ABSORPTION AND LIKELY TO CONT IN THE
NEAR TERM. CMPL AND PERIODIC LOSS OF HF ON THE SUNLIT
SIDE OF THE EARTH EXP. CONT HF COM DEGRADATION LIKELY
OVER THE NXT 7 DAYS. SEE WWW.SPACEWEATHERPROVIDER.WEB
NXT ADVISORY: 20161108/0700Z

*Fictitious location

2. Training:

For a brief overview of NWS SWPC's products and services please go [here](#). Descriptions of each space weather advisory and phenomena in detail are found in ICAO Doc 10100 *Manual on Space Weather Information in Support of International Air Navigation*.

3. Availability:

The SWXCs shall maintain a 24-hour watch. SWXC advisories will be issued as conditions warrant according to the table in Part 2, Section 1. Once an advisory is issued, it will be updated at six-hour intervals from the nearest hour *after* the advisory is issued until the space weather phenomena are no longer detected and/or are no longer expected to have an impact.